REMARKS/ARGUMENTS

Under separate cover, applicant encloses a request for a three-month extension of time.

Drawing Corrections

As requested, Figure 1 has been amended by the addition of the legend "Prior Art".

With respect to the reference 60, this correctly designates connection ports at one end of the stack in Figures 2a and 2b. The former reference 60 in the upper left of Figure 2b has been corrected to 80, this being an indication of the end plate at one of the stack.

The Examiner's interpretation of the previously filed voluntary amendment is correct. There is no Figure 2C. Paragraph 48 is being corrected accordingly.

With respect to the reference numeral 14 in paragraph 50, this has been corrected to the reference 40.

Some additional changes to the drawings are also noted. All of these are being entered solely to ensure internal consistency between the drawings and the specification, without adding any new matter.

As Figures 3 and 4 indicate, for each of the fuel cell portion and the electrolyzer portion, the connection ports are inherently offset from one another. Thus, for example for a fuel gas, a connection port is on one side of the stack at one end, and since the flow field plates cause the gas to flow from one side of the stack to the other, the connection port at the other end is then on the other side of the stack or offset from the first connection port. When you have the fuel cell portion and the electrolyzer portion connected together, this offsetting affect is cancelled out. Thus, while the connection ports 41, 42 and 43 (Figures 3 and 4) between the fuel cell and electrolyzer portions are offset from the corresponding connection ports at the ends of the stack, this does mean that the connection ports at the ends, e.g. port pairs 50, 60; 52, 62; 53, 63 are all aligned with one another.

On review, it has now been realized that these ports are not consistently shown in the schematic, exploded view of Figures 2a, 2b, 6 and 7. Accordingly, these four figures are all being corrected to bring them into agreement with Figures 3 and 4. Again, no new matter has been added.

In Figure 8b, the reference to H_2O has been changed to just H_2, since as clearly described in the specification, the connection 92 is to hydrogen storage.

Claim Rejections

The Examiner had rejected claims 1-16, 19 and 24 as being indefinite under 35 U.S.C. 112. More particularly, the Examiner argued that the terms "gas bypass conduit" and "gas bypass port" are indefinite because they are not defined and clearly illustrated in the specification. This argument is respectfully traversed.

For example, in paragraph 49, at page 16, lines 5-9, it is made clear that the port 62 is designated as a "bypass port", as the oxidant is considered to bypass the active area of the electrolyzer cells. At paragraph 16 on page 6, it is noted that the gas bypass of the electrolyzer portion is provided on the face of the anode bipolar plate of each electrolyzer cell facing away from the proton exchange membrane. Reference is also made to this bypass function at paragraph 45, lines 23, 24; and in the detailed discussion of Figure 3b in paragraph 56. For the avoidance of ambiguity, paragraph 56 is being amended to make is clear that the air bypass flow fields collectively form the air bypass conduit. No new matter has been added.

With respect to claims 8 and 19, the Examiner had argued that the term "anode bipolar plate" and "cathode bipolar plate" are "not indefinite" (sic); presumably, the Examiner intended to argue that they are indefinite. The term "bipolar" has been replaced in claims 8, 9 and 11 (not claim 19) by the term "flow field". Also, by way of clarification, a sentence is being added to paragraph 70.

The Examiner further argued with the reference to "said anode bipolar plates" and "said cathode bipolar plates" had no antecedent basis in claim 8. It is submitted that this argument is incorrect. Claim 8 now refers to each of a "plurality of individual cells" having an "anode flow field plate" and a "cathode flow field plate". Thus, since there are

a plurality of cells, there is, inherently and implicitly, a plurality of each of the two types of flow field plates. Accordingly, there is then proper antecedent basis to refer, later in this claim, to "said anode bipolar plates" and "said cathode bipolar plates". Similar arguments apply to claim 9, which has a similar structure, although the Examiner had not noted such an argument for claim 9.

The Examiner then rejected claims 1-9 and 17-28 as being anticipated by Levy et al., U.S. Patent 4,839,247. This argument is respectfully traversed. It is submitted that the Examiner has significantly misconstrued the disclosure in this patent.

The Examiner correctly notes that Levy et al. '247 discloses interleaved fuel cells and electrolysis cells. Storage is provided for both gaseous oxygen and hydrogen at 4 and 6, and to connect this to the fuel and electrolysis cells, there are provided oxygen manifolds 32, 34 and a hydrogen plenum 22.

However, the Examiner then argued that Figure 2 shows the electrolyzer cathode and anode inlets and outlets are connected to the fuel cell oxidant and fuel ports. It is submitted that this analysis is superficial and incorrect.

Figure 4 shows the detailed structure of the system. A fuel cell subassembly 18 has connections at 33, 52 for oxygen and hydrogen respectively. An electrolysis cell subassembly 20 has connections at 74 and 71 for hydrogen and oxygen respectively. Significantly, all these hydrogen and oxygen connections are just to the oxygen manifolds 30, 32 and the hydrogen plenum 22.

More significantly, the cells of the assemblies are not in any sense arranged in series. More significantly, not a single one of the cells is arranged for gas to flow through from a port on one side to a port on the other side. Each of the cells is essentially dead-ended. Each of the fuel cells subassemblies 18 has a connection to provide for flow of the reactant gases to the subassembly, directly from the oxygen and hydrogen supplies, with no provision for exhausted gas to flow through the fuel cell subassembly, nor any provision for the gas to flow through to an electrolysis cell. Correspondingly, each of the electrolysis cell subassemblies 20 simply provides for the generated gas to be discharged into the respective supply conduits for oxygen and

hydrogen, with there being no provision for gas to flow through the fuel cell and the electrolysis cells in sequence.

In contrast, the present invention provides an arrangement in which, at least in the preferred embodiment, each of the flows of hydrogen, oxygen and coolant pass through a fuel cell portion and through the electrolysis portion. As claimed, claim 1 calls for there to be at least one connection for, in effect, at least one of these flows.

To better clarify the invention, claim 1 has been amended. Firstly, the reference to the gas bypass conduit and gas bypass ports is now introduced in element (c) of the claim for greater clarity. Moreover, each of the elements (a), (b) and (c) has been amended to make it clear that the relevant connection is not just between a pair of ports, but does provide a through connection between relevant parts of the electrolyzer and fuel cell portions. Thus, in element (a) the connection between the second electrolyzer cathode port and the second fuel cell anode port is now specified to provide a passage between the first electrolyzer cathode and fuel cell anode ports, and also through the electrolyzer cathode and the fuel cell anode. Similar amendments have been made to elements (b) and (c).

No such arrangement is anywhere taught or suggested in Levy et al. Indeed, due to the dead-ended structure of each of the individual cell subassemblies, it is physically impossible to flow gas through, for example, one fuel cell subassembly to the electrolysis cell subassemblies or vice versa.

The provision of providing this through connection or series connection between the fuel cell and electrolysis portions has a number of advantages. It greatly simplifies the structure of the combined regenerative cell, enabling the fuel cell and electrolysis cell portions to be stacked together and clamped together. In general, it will be uncommon to run the electrolysis and fuel cell portions simultaneously. However, it will often be desirable to switch from one mode of operation to the other relatively quickly. Bypassing the operating fluids through the two portions, ensures that, whichever of the fuel cell and electrolysis portions is idle, can be kept warm, ready for operation. There are other advantages. For example, as shown in Figures 5a, 5b and described in the specification, in the fuel cell mode of operation, as the cooling water passes through the

anode of the electrolysis cell, this can result in water transfer through the membrane through the cathode of the electrolysis portion, resulting in both heating and humidification of incoming hydrogen fuel. Similarly, passage of air through the electrolysis portion in the fuel cell mode may also result in desirable preheating of the air or oxidant. In the electrolysis mode of operation, the heat generated by electrolysis can be useful in maintaining the fuel cell portion warm. It can additionally ensure that the anode at least at the fuel cell portion is maintained flushed with hydrogen, ready for operation.

Accordingly, it is submitted that the invention as claimed in claim 1 is clearly not disclosed in the sense required by 35 U.S.C. 102 in Levy et al. '247.

With respect to arguments concerning provisions for a duct for water passing between the electrolysis portion and fuel portion, this is clearly not disclosed in Levy et al. The Levy et al. '247 patent teaches an interleaved structure with the fuel cell and electrolysis cell subassemblies alternating with one another. It then provides plates such as 44, 64 as an electrolyte reservoir and a water reservoir. The clear teaching is that water generated during fuel cell operating be retained between the fuel cell and electrolysis cell subassemblies, ready for use in the electrolysis mode of operation. There is simply no provision for the draining of water from the fuel cell subassemblies or supply of water to the electrolysis cell subassemblies. Accordingly, it is submitted that this aspect of the present invention can in no sense be derived from this disclosure.

The Examiner also identified, in the '247 patent, end plates 55 and 73 and insulating plates 17 and 5. Again, it is submitted that these elements have no parallel with elements of the present invention, since the structure in this patent is concerned with an alternating structure of fuel cell subassemblies and electrolysis cell subassemblies. In contrast, the present invention is concerned with a fuel cell portion having a plurality of fuel cells and an electrolysis cell portion having a plurality of electrolysis cells. Thus, the end and insulating plates form entirely different functions in the present invention. In the present invention, within each of the electrolysis and fuel cell portions, there is no need for and no provision of individual end plates or insulating

plates. Rather, it is necessary that there be an electrical connection between each adjacent pair of cells, in each of the fuel cell and electrolysis cell portions.

The Examiner's short one line argument that water and coolant transfer is provided through plate 44 can in no way be equated with the through conduit in the present invention providing for passage of unlimited quantity of water through both of the fuel cell and electrolysis portions. Again, in Levy et al. water is retained and there is no passage or conduit to move water from a fuel cell portion to an electrolysis portion.

A number of other minor, clarifying amendments have been made to claims dependent from claim 1. Thus, both claims 2 and 3 now refer to "the connection" since there is an antecedent for this in claim 1. Claim 3 has further been amended in light of the amendments to claim 1.

It is submitted that the claims dependent from claim 1 are also allowable, as being dependent from an allowable claim and for introducing further patentable features.

With respect to claim 17, this has been amended to refer to the presence of at least one passage for a fluid extending through both of the electrolyzer and fuel cell portions and including respective connection portions, etc. Again, this is intended to emphasis the fact that, in the present invention, there is a continuous passage providing for through flow of an operating fluid and extending through both of the fuel cell and electrolyzer portions. The feature nowhere found in the prior art.

Again, the claims dependent from claim 17 are submitted to be allowable by reason of their dependency from claim 17 and for introducing further patentable features.

With respect to the main method claim, this is being amended to refer to the two different operating modes being affected alternately. For clarity, claim 24 has been amended to refer to the fuel cell mode of operation. It is submitted that all the method claims are allowable for reasons similar to those given above.

Amendments to the Specification

In the specification, a number of minor clerical errors have been corrected as set out in the amended paragraphs. It is submitted that all of these are clear on their face and require no further comment. No new matter has been added.

Early review and allowance are respectfully requested.

Respectfully submitted,

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Attachments